

# REPORT DOCUMENTATION PAGE

Form Approved  
OPM No

2

AD-A262 960



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ry Affairs, Office of Management and Budget, Washington, DC 20503

2. REPORT

3. REPORT TYPE AND DATES

Final: 30 April 1992

4. TITLE AND

Validation Summary Report: TLD Systems, Ltd., TLD Sun-4/MIL-STD-1750A  
Ada Compiler Systems, Verssion 2.9.0, Sun-4/75 under SunOS, Version  
4.1.1 (Host) to Honeywell Program Deveopment Unit(Target)

5. FUNDING

6.

Wright-Patterson AFB, Dayton, OH  
USA

7. PERFORMING ORGANIZATION NAME(S) AND

Ada Validation Facility, Language Control Facility ASD/SCEL  
Bldg. 676, Rm 135  
Wright-Patterson AFB, Dayton, OH 45433

8. PERFORMING  
ORGANIZATION

AVF-VSR-525-0392

9. SPONSORING/MONITORING AGENCY NAME(S) AND

Ada Joint Program Office  
United States Department of Defense  
Pentagon, Rm 3E114  
Washington, D.C. 20301-3081

10. SPONSORING MONITORING  
AGENCY

11. SUPPLEMENTARY

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12a. DISTRIBUTION/AVAILABILITY

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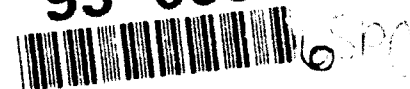
12b. DISTRIBUTION

13. (Maximum 200)

TLD Systems, Ltd., TLD Sun-4/MIL-STD-1750A Ada Compiler System, Version 2.9.0, Sun-4/75, under SunOS,  
Version 4.1.1 (Host) to Honeywell Program Development Unit (PDU) with Honeywell Generic VHSIC  
Spaceborne Computer (GVSC) MIL-STD-1750A under TLDrtx Real Time Executive, Version 1.0.0 (Target),  
ACVC 1.11, 920319W1.11239

98 3 30 071

93-06533



14. SUBJECT

Ada programming language, Ada Compiler Val. Summary Report, Ada Compiler Val.  
Capability, Val. Testing, Ada Val. Office, Ada Val. Facility, ANSI/MIL-STD-1815A,

15. NUMBER OF

16. PRICE

17. SECURITY  
CLASSIFICATION  
UNCLASSIFIED

18. SECURITY  
UNCLASSIFIED

19. SECURITY  
CLASSIFICATION  
UNCLASSIFIED

20. LIMITATION OF

# Certificate Information

The following Ada implementation was tested and determined to pass ACVC 1.11. Testing was completed on 19 March 1992.

Compiler Name and Version: TLD Sun-4/MIL-STD-1750A Ada Compiler System, Version 2.9.0

Host Computer System: Sun-4/75,  
under SunOS, Version 4.1.1

Target Computer System: Honeywell Program Development Unit (PDU)  
with Honeywell Generic VHSIC Spaceborne  
Computer (GVSC) MIL-STD-1750A  
under TLDrtx Real Time Executive, Version 1.0.0


Customer Agreement Number: 91-11-14-TLD

See section 3.1 for any additional information about the testing environment.


As a result of this validation effort, Validation Certificate 920319W1.11239 is awarded to TLD Systems, Ltd. This certificate expires on 1 June 1993.


This report has been reviewed and is approved.

**DTIC QUALITY INSPECTED 1**

  
Ada Validation Facility  
Steven P. Wilson  
Technical Director  
ASD/SCEL  
Wright-Patterson AFB OH 45433-6503

Accession For	
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Unannounced	<input type="checkbox"/>
Justification	
By _____	
Distribution/	
Availability Codes	
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A-1	

  
for Ada Validation Organization  
Director, Computer and Software Engineering Division  
Institute for Defense Analyses,  
Alexandria VA 22311

  
Ada Joint Program Office  
Dr. John Solomond, Director  
Department of Defense  
Washington DC 20301

AVF Control Number: AVF-VSR-525-0392

30 April 1992

91-11-14-TLD

Ada COMPILER

VALIDATION SUMMARY REPORT:

Certificate Number: 920319W1.11239

TLD Systems, Ltd.

TLD Sun-4/MIL-STD-1750A Ada Compiler System, Version 2.9.0

Sun-4/75 under SunOS, Version 4.1.1 =>

Honeywell Program Development Unit (PDU) with

Honeywell Generic VHSIC Spaceborne Computer (GVSC) MIL-STD-1750A  
under TLDrtx Real Time Executive, Version 1.0.0

Prepared By:

Ada Validation Facility

ASD/SCEL

Wright-Patterson AFB OH 45433-6503

DECLARATION OF CONFORMANCE

Customer: TLD Systems, Ltd.

Ada Validation Facility: ASD/SCEL, Wright-Patterson AFB, OH 45433-6503

ACVC Version: 1.11

Ada Implementation:

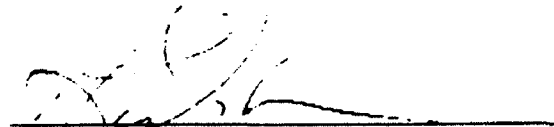
Compiler Name and Version: TLD Sun-4/MIL-STD-1750A Ada Compiler System,  
Version 2.9.0

Host Computer System: Sun-4/75, SunOS, Version 4.1.1

Target Computer System: Honeywell Program Development Unit (PDU) with  
Honeywell Generic VHSIC Spaceborne Computer  
(GVSC) MIL-STD-1750A  
TLDrtx Real Time Executive, Version 1.0.0

Customer's Declaration

I, the undersigned, representing TLD Systems, Ltd., declare that TLD Systems, Ltd. has no knowledge of deliberate deviations from the Ada Language Standard ANSI/MIL-STD-1815A in the implementation listed in this declaration executing in the default mode. The certificates shall be awarded in TLD-Systems, Ltd.'s corporate name.

  
TLD Systems, Ltd.  
Terry L. Dunbar, President

Date: 29 February 1992

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## CHAPTER 1

### INTRODUCTION

The Ada implementation described above was tested according to the Ada Validation Procedures [Pro90] against the Ada Standard [Ada83] using the current Ada Compiler Validation Capability (ACVC). This Validation Summary Report (VSR) gives an account of the testing of this Ada implementation. For any technical terms used in this report, the reader is referred to [Pro90]. A detailed description of the ACVC may be found in the current ACVC User's Guide [UG89].

#### 1.1 USE OF THIS VALIDATION SUMMARY REPORT

Consistent with the national laws of the originating country, the Ada Certification Body may make full and free public disclosure of this report. In the United States, this is provided in accordance with the "Freedom of Information Act" (5 U.S.C. #552). The results of this validation apply only to the computers, operating systems, and compiler versions identified in this report.

The organizations represented on the signature page of this report do not represent or warrant that all statements set forth in this report are accurate and complete, or that the subject implementation has no nonconformities to the Ada Standard other than those presented. Copies of this report are available to the public from the AVF which performed this validation or from:

National Technical Information Service  
5285 Port Royal Road  
Springfield VA 22161

Questions regarding this report or the validation test results should be directed to the AVF which performed this validation or to:

Ada Validation Organization  
Computer and Software Engineering Division  
Institute for Defense Analyses  
1801 North Beauregard Street  
Alexandria VA 22311-1772

## INTRODUCTION

### 1.2 REFERENCES

- [Ada83] Reference Manual for the Ada Programming Language,  
ANSI/MIL-STD-1815A, February 1983 and ISO 8652-1987.
- [Pro90] Ada Compiler Validation Procedures, Version 2.1, Ada Joint  
Program Office, August 1990.
- [UG89] Ada Compiler Validation Capability User's Guide, 21 June 1989.

### 1.3 ACVC TEST CLASSES

Compliance of Ada implementations is tested by means of the ACVC. The ACVC contains a collection of test programs structured into six test classes: A, B, C, D, E, and L. The first letter of a test name identifies the class to which it belongs. Class A, C, D, and E tests are executable. Class B and class L tests are expected to produce errors at compile time and link time, respectively.

The executable tests are written in a self-checking manner and produce a PASSED, FAILED, or NOT APPLICABLE message indicating the result when they are executed. Three Ada library units, the packages REPORT and SPPRT13, and the procedure CHECK\_FILE are used for this purpose. The package REPORT also provides a set of identity functions used to defeat some compiler optimizations allowed by the Ada Standard that would circumvent a test objective. The package SPPRT13 is used by many tests for Chapter 13 of the Ada Standard. The procedure CHECK\_FILE is used to check the contents of text files written by some of the Class C tests for Chapter 14 of the Ada Standard. The operation of REPORT and CHECK\_FILE is checked by a set of executable tests. If these units are not operating correctly, validation testing is discontinued.

Class B tests check that a compiler detects illegal language usage. Class B tests are not executable. Each test in this class is compiled and the resulting compilation listing is examined to verify that all violations of the Ada Standard are detected. Some of the class B tests contain legal Ada code which must not be flagged illegal by the compiler. This behavior is also verified.

Class L tests check that an Ada implementation correctly detects violation of the Ada Standard involving multiple, separately compiled units. Errors are expected at link time, and execution is attempted.

In some tests of the ACVC, certain macro strings have to be replaced by implementation-specific values — for example, the largest integer. A list of the values used for this implementation is provided in Appendix A. In addition to these anticipated test modifications, additional changes may be required to remove unforeseen conflicts between the tests and implementation-dependent characteristics. The modifications required for this implementation are described in section 2.3.

For each Ada implementation, a customized test suite is produced by the AVF. This customization consists of making the modifications described in the preceding paragraph, removing withdrawn tests (see section 2.1), and possibly removing some inapplicable tests (see section 2.2 and [UG89]).

In order to pass an ACVC an Ada implementation must process each test of the customized test suite according to the Ada Standard.

#### 1.4 DEFINITION OF TERMS

Ada Compiler	The software and any needed hardware that have to be added to a given host and target computer system to allow transformation of Ada programs into executable form and execution thereof.
Ada Compiler Validation Capability (ACVC)	The means for testing compliance of Ada implementations, consisting of the test suite, the support programs, the ACVC user's guide and the template for the validation summary report.
Ada Implementation	An Ada compiler with its host computer system and its target computer system.
Ada Joint Program Office (AJPO)	The part of the certification body which provides policy and guidance for the Ada certification system.
Ada Validation Facility (AVF)	The part of the certification body which carries out the procedures required to establish the compliance of an Ada implementation.
Ada Validation Organization (AVO)	The part of the certification body that provides technical guidance for operations of the Ada certification system.
Compliance of an Ada Implementation	The ability of the implementation to pass an ACVC version.
Computer System	A functional unit, consisting of one or more computers and associated software, that uses common storage for all or part of a program and also for all or part of the data necessary for the execution of the program; executes user-written or user-designated programs; performs user-designated data manipulation, including arithmetic operations and logic operations; and that can execute programs that modify themselves during execution. A computer system may be a stand-alone unit or may consist of several inter-connected units.



## INTRODUCTION

Conformity	Fulfillment by a product, process, or service of all requirements specified.
Customer	An individual or corporate entity who enters into an agreement with an AVF which specifies the terms and conditions for AVF services (of any kind) to be performed.
Declaration of Conformance	A formal statement from a customer assuring that conformity is realized or attainable on the Ada implementation for which validation status is realized.
Host Computer System	A computer system where Ada source programs are transformed into executable form.
Inapplicable test	A test that contains one or more test objectives found to be irrelevant for the given Ada implementation.
ISO	International Organization for Standardization.
LRM	The Ada standard, or Language Reference Manual, published as ANSI/MIL-STD-1815A-1983 and ISO 8652-1987. Citations from the LRM take the form "<section>.<subsection>:<paragraph>."
Operating System	Software that controls the execution of programs and that provides services such as resource allocation, scheduling, input/output control, and data management. Usually, operating systems are predominantly software, but partial or complete hardware implementations are possible.
Target Computer System	A computer system where the executable form of Ada programs are executed.
Validated Ada Compiler	The compiler of a validated Ada implementation.
Validated Ada Implementation	An Ada implementation that has been validated successfully either by AVF testing or by registration [Pro90].
Validation	The process of checking the conformity of an Ada compiler to the Ada programming language and of issuing a certificate for this implementation.
Withdrawn test	A test found to be incorrect and not used in conformity testing. A test may be incorrect because it has an invalid test objective, fails to meet its test objective, or contains erroneous or illegal use of the Ada programming language.

## CHAPTER 2

### IMPLEMENTATION DEPENDENCIES

#### 2.1 WITHDRAWN TESTS

The following tests have been withdrawn by the AVO. The rationale for withdrawing each test is available from either the AVO or the AVF. The publication date for this list of withdrawn tests is 2 August 1991.

E28005C	B28006C	C32203A	C34006D	C35508I	C35508J
C35508M	C35508N	C35702A	C35702B	B41308B	C43004A
C45114A	C45346A	C45612A	C45612B	C45612C	C45651A
C46022A	B49008A	B49008B	A74006A	C74308A	B83022B
B83022H	B83025B	B83025D	C83026A	B83026B	C83041A
B85001L	C86001F	C94021A	C97116A	C98003B	BA2011A
CB7001A	CB7001B	CB7004A	CC1223A	BC1226A	CC1226B
BC3009B	BD1B02B	BD1B06A	AD1B08A	BD2A02A	CD2A21E
CD2A23E	CD2A32A	CD2A41A	CD2A41E	CD2A87A	CD2B15C
BD3006A	BD4008A	CD4022A	CD4022D	CD4024B	CD4024C
CD4024D	CD4031A	CD4051D	CD5111A	CD7004C	ED7005D
CD7005E	AD7006A	CD7006E	AD7201A	AD7201E	CD7204B
AD7206A	BD8002A	BD8004C	CD9005A	CD9005B	CDA201E
CE2107I	CE2117A	CE2117B	CE2119B	CE2205B	CE2405A
CE3111C	CE3116A	CE3118A	CE3411B	CE3412B	CE3607B
CE3607C	CE3607D	CE3812A	CE3814A	CE3902B	

#### 2.2 INAPPLICABLE TESTS

A test is inapplicable if it contains test objectives which are irrelevant for a given Ada implementation. Reasons for a test's inapplicability may be supported by documents issued by the ISO and the AJPO known as Ada Commentaries and commonly referenced in the format AI-ddddd. For this implementation, the following tests were determined to be inapplicable for the reasons indicated; references to Ada Commentaries are included as appropriate.

## IMPLEMENTATION DEPENDENCIES

The following 285 tests have floating-point type declarations requiring more digits than `SYSTEM.MAX_DIGITS`:

C24113F..Y (20 tests)	C35705F..Y (20 tests)
C35706F..Y (20 tests)	C35707F..Y (20 tests)
C35708F..Y (20 tests)	C35802F..Z (21 tests)
C45241F..Y (20 tests)	C45321F..Y (20 tests)
C45421F..Y (20 tests)	C45521F..Z (21 tests)
C45524F..Z (21 tests)	C45621F..Z (21 tests)
C45641F..Y (20 tests)	C46012F..Z (21 tests)

The following 21 tests check for the predefined type `SHORT_INTEGER`; for this implementation, there is no such type:

C35404B	B36105C	C45231B	C45304B	C45411B
C45412B	C45502B	C45503B	C45504B	C45504E
C45611B	C45613B	C45614B	C45631B	C45632B
B52004E	C55B07B	B55B09D	B86001V	C86006D
CD7101E				

C35404D, C45231D, B86001X, C86006E, and CD7101G check for a predefined integer type with a name other than `INTEGER`, `LONG_INTEGER`, or `SHORT_INTEGER`; for this implementation, there is no such type.

C35713B, C45423B, B86001T, and C86006H check for the predefined type `SHORT_FLOAT`; for this implementation, there is no such type.

C35713D and B86001Z check for a predefined floating-point type with a name other than `FLOAT`, `LONG_FLOAT`, or `SHORT_FLOAT`; for this implementation, there is no such type.

A35801E checks that `FLOAT'FIRST..FLOAT'LAST` may be used as a range constraint in a floating-point type declaration; for this implementation, that range exceeds the range of safe numbers of the largest predefined floating-point type and must be rejected. (See section 2.3.)

C45531M..P and C45532M..P (8 tests) check fixed-point operations for types that require a `SYSTEM.MAX_MANTISSA` of 47 or greater; for this implementation, `MAX_MANTISSA` is less than 47.

C45536A, C46013B, C46031B, C46033B, and C46034B contain length clauses that specify values for `'SMALL` that are not powers of two or ten; this implementation does not support such values for `'SMALL`.

C45624A..B (2 tests) check that the proper exception is raised if `MACHINE_OVERFLOW`s is `FALSE` for floating point types and the results of various floating-point operations lie outside the range of the base type; for this implementation, `MACHINE_OVERFLOW`s is `TRUE`.

## IMPLEMENTATION DEPENDENCIES

D64005F..G (2 tests) use 10 levels of recursive procedure calls nesting; this level of nesting for procedure calls exceeds the capacity of the compiler.

B86001Y uses the name of a predefined fixed-point type other than type DURATION; for this implementation, there is no such type.

LA3004A..B, EA3004C..D, and CA3004E..F (6 tests) check pragma INLINE for procedures and functions; this implementation does not support pragma INLINE.

CD1009C checks whether a length clause can specify a non-default size for a floating-point type; this implementation does not support such sizes.

CD2A53A checks operations of a fixed-point type for which a length clause specifies a power-of-ten TYPE'SMALL; this implementation does not support decimal 'SMALLs. (See section 2.3.)

CD2A84A, CD2A84E, CD2A84I..J (2 tests), and CD2A84O use length clauses to specify non-default sizes for access types; this implementation does not support such sizes.

The following 264 tests check operations on sequential, text, and direct access files; this implementation does not support external files (see Section 2.3 regarding CE3413B):

CE2102A..C (3)	CE2102G..H (2)	CE2102K	CE2102N..Y (12)
CE2103C..D (2)	CE2104A..D (4)	CE2105A..B (2)	CE2106A..B (2)
CE2107A..H (8)	CE2107L	CE2108A..H (8)	CE2109A..C (3)
CE2110A..D (4)	CE2111A..I (9)	CE2115A..B (2)	CE2120A..B (2)
CE2201A..C (3)	EE2201D..E (2)	CE2201F..N (9)	CE2203A
CE2204A..D (4)	CE2205A	CE2206A	CE2208B
CE2401A..C (3)	EE2401D	CE2401E..F (2)	EE2401G
CE2401H..L (5)	CE2403A	CE2404A..B (2)	CE2405B
CE2406A	CE2407A..B (2)	CE2408A..B (2)	CE2409A..B (2)
CE2410A..B (2)	CE2411A	CE3102A..C (3)	CE3102F..H (3)
CE3102J..K (2)	CE3103A	CE3104A..C (3)	CE3106A..B (2)
CE3107B	CE3108A..B (2)	CE3109A	CE3110A
CE3111A..B (2)	CE3111D..E (2)	CE3112A..D (4)	CE3114A..B (2)
CE3115A	CE3119A	EE3203A	EE3204A
CE3207A	CE3208A	CE3301A	EE3301B
CE3302A	CE3304A	CE3305A	CE3401A
CE3402A	EE3402B	CE3402C..D (2)	CE3403A..C (3)
CE3403E..F (2)	CE3404B..D (3)	CE3405A	EE3405B
CE3405C..D (2)	CE3406A..D (4)	CE3407A..C (3)	CE3408A..C (3)
CE3409A	CE3409C..E (3)	EE3409F	CE3410A
CE3410C..E (3)	EE3410F	CE3411A	CE3411C
CE3412A	EE3412C	CE3413A..C (3)	CE3414A
CE3602A..D (4)	CE3603A	CE3604A..B (2)	CE3605A..E (5)
CE3606A..B (2)	CE3704A..F (6)	CE3704M..O (3)	CE3705A..E (5)
CE3706D	CE3706F..G (2)	CE3804A..P (16)	CE3805A..B (2)

## IMPLEMENTATION DEPENDENCIES

CE3806A..B (2)    CE3806D..E (2)    CE3806G..H (2)    CE3904A..B (2)  
CE3905A..C (3)    CE3905L            CE3906A..C (3)    CE3906E..F (2)

CE2103A, CE2103B, and CE3107A use an illegal file name in an attempt to create a file and expect NAME\_ERROR to be raised; this implementation does not support external files and so raises USE\_ERROR. (See section 2.3.)

## 2.3 TEST MODIFICATIONS

Modifications (see section 1.3) were required for 1345 tests.

The following tests were split into two or more tests because this implementation did not report the violations of the Ada Standard in the way expected by the original tests.

B44004D    B59001E    B73004B    BA1001A

C34003A, and C45521A..E (5 tests) were graded passed by Evaluation Modification as directed by the AVO. These tests check that operations for floating-point types are correctly implemented; but the target computer's division operation introduces an error in the least-significant bit, and some of the tests' checks for division are failed. The AVO ruled that this behavior is allowable as per AI-00325--that implementing division in software to compensate for the target computer is not practical. These tests were graded passed given that the only Report.Failed output was:

for C34003A:

\* C34003A INCORRECT /.

for C45521A..E, where '<x>' is replaced by the 'A'..'E', respectively (here, Report.Failed output must be identified by the Report.Comment output it follows):

- C45521<x> (G) CHECK /; A, B, A/B ALL MODEL NUMBERS.
- \* C45521<x> THE RESULT IS INCORRECT.
- C45521<x> (J) CHECK /; A, B, A/B ALL MODEL NUMBERS; DIFFERENT SUBTYPES.
- \* C45521<x> THE RESULT IS INCORRECT.

C34009D and C34009J were graded passed by Evaluation Modification as directed by the AVO. These tests check that 'SIZE for a composite type is greater than or equal to the sum of its components' 'SIZE values; but this issue is addressed by AI-00825, which has not been considered; there is not an obvious interpretation. This implementation represents array components whose length depends on a discriminant with a default value by implicit pointers into the heap space; thus, the 'SIZE of such a record type might be less than the sum of its components 'SIZES, since the size of the heap space that is used by the varying-length array components is not counted as part of the 'SIZE of the record type. These tests were graded passed given

## IMPLEMENTATION DEPENDENCIES

that the Report.Result output was "FAILED" and the only Report.Failed output was "INCORRECT 'BASE'SIZE", from line 195 in C34009D and line 193 in C34009J.

A35801E was graded inapplicable by Evaluation Modification as directed by the AVO. The compiler rejects the use of the range FLOAT'FIRST..FLOAT'LAST as the range constraint of a floating-point type declaration because the bounds lie outside of the range of safe numbers (cf. LRM 3.5.7:12).

C83030C and C86007A were graded passed by Test Modification as directed by the AVO. These tests were modified by inserting "PRAGMA ELABORATE (REPORT);" before the package declarations at lines 13 and 11, respectively. Without the pragma, the packages may be elaborated prior to package Report's body, and thus the packages' calls to function REPORT.IDENT INT at lines 14 and 13, respectively, will raise PROGRAM\_ERROR.

The tests below were graded passed by Test Modification as directed by the AVO. These tests all use one of the generic support procedures, Length Check or Enum Check (in support files LENCHECK.ADA & ENUMCHEK.ADA), which use the generic procedure Unchecked Conversion. This implementation rejects instantiations of Unchecked Conversion with array types that have non-static index ranges. The AVO ruled that since this issue was not addressed by AI-00590, which addresses required support for Unchecked Conversion, and since AI-00590 is considered not binding under ACVC 1.11, the support procedures could be modified to remove the use of Unchecked Conversion. Lines 40..43, 50, and 56..58 in LENCHECK and lines 42, 43, and 58..63 in ENUMCHEK were commented out.

CD1009A	CD1009I	CD1009M	CD1009V	CD1009W	CD1C03A
CD1C04D	CD2A21A..C	CD2A22J	CD2A23A..B	CD2A24A	CD2A31A..C
*CD2A81A	CD3014C	CD3014F	CD3015C	CD3015E..F	CD3015H
CD3015K	CD3022A	CD4061A			

\*CD2A81A, CD2A81B, CD2A81E, CD2A83A, CD2A83B, CD2A83C, and CD2A83E were graded passed by Test Modification as directed by the AVO. These tests check that operations of an access type are not affected if a 'SIZE clause is given for the type; but the standard customization of the ACVC allows only a single size for access types. This implementation uses a larger size for access types whose designated object is of type STRING. The tests were modified by incrementing the specified size \$ACC\_SIZE with '+ 32'.

CE2103A, CE2103B, and CE3107A were graded inapplicable by Evaluation Modification as directed by the AVO. The tests abort with an unhandled exception when USE\_ERROR is raised on the attempt to create an external file. This is acceptable behavior because this implementation does not support external files (cf. AI-00332).

CE3413B was graded inapplicable by Evaluation Modification as directed by the AVO. This test includes the expression "COUNT'LAST > 150000", which raises CONSTRAINT ERROR on the implicit conversion of the integer literal to type COUNT since COUNT'LAST = 32,767; there is no handler for this exception, so test execution is terminated. The AVO ruled that this

## IMPLEMENTATION DEPENDENCIES

behavior was acceptable; the AVO ruled that the test be graded inapplicable because it checks certain file operations and this implementation does not support external files.

Many of the Class A and Class C (executable) test files were combined into single procedures ("bundles") by the AVF, according to information supplied by the customer and guidance from the AVO. This bundling was done in order to reduce the processing time—compiling, linking, and downloading to the target. For each test that was bundled, its context clauses for packages Report and (if present) SYSTEM were commented out, and the modified test was inserted into the declarative part of a block statement in the bundle. The general structure of each bundle was:

```

WITH REPORT, TEXT_IO, SYSTEM;
PROCEDURE <BUNDLE_NAME> IS

-- repeated for each test

  DECLARE
    <TEST FILE>      [a modified test is inserted here, ...]
  BEGIN
    <TEST NAME>;      [... and invoked here]

    EXCEPTION        --test is not expected to reach this exception handler
      WHEN OTHERS => REPORT.FAILED("unhandled exception ");
                    REPORT.RESULT;

  END;
  TEXT_IO.NEW_LINE;

--      [... repeated for each test in the bundle]

  TEXT_IO.PUT_LINE ("GROUP TEST <BUNDLE_NAME> COMPLETED");
  END <BUNDLE_NAME>;

```

The 1293 tests that were processed in bundles are listed below; each bundle is delimited by '<' and '>'.

<A21001A	A22002A	A22006B	A26004A	A26007A	A27003A	A27004A
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A29002H	A29002I	A29002J	A29003A	A2A031A>	<A32203B	A32203C
A32203D	A33003A	A34017C	A35101B	A35402A	A35502Q	A35502R
A35710A	A35801A	A35801B	A35801F	A35902C	A38106D	A38106E
A38199A	A39005B	A39005C	A39005D	A39005E	A39005F>	<A39005G
A54B01A	A54B02A	A55B12A	A55B13A	A55B14A	A62006D	A71002A
A71004A	A72001A	A73001I	A73001J	A74105B	A74106A	A74106B
A74106C	A74205E	A74205F>	<A83009A	A83009B	A83041B	A83041C
A83041D	A83A02A	A83A02B	A83A06A	A83A08A	A83C01C	A83C01D
A83C01E	A83C01F	A83C01G	A83C01H	A83C01I	A83C01J	A85007D
A85013B	A87B59A>	<A87006A	AC1015B	AC3106A	AC3206A	AC3207A>
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AD7102A	AD7103A	AD7103C>	<AD7104A	AD7203B	AD7205B>	<C23001A
C23003A	C23006A	C24002A	C24002B	C24002C	C24003A	C24003B
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## IMPLEMENTATION DEPENDENCIES

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C32111A	C32111B>	<C32112A	C32112B	C32113A>	<C32114A	C32115A
C32115B>	<C32117A	C34001A	C34001C	C34001D	C34001F	C34002A
C34002C	C34003A	C34003C>	<C34004A	C34004C	C34005A	C34005C>
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C34005O>	<C34005P	C34005R	C34005S	C34005U	C34006A	C34006F
C34006G	C34006J>	<C34006L	C34007A	C34007D	C34007F	C34007G>
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# IMPLEMENTATION DEPENDENCIES

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C52005F>	<C52007A	C52008A	C52008B	C52009A	C52009B	C52010A
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C52103F	C52103G	C52103H	C52103K	C52103L>	<C52103M	C52103P
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## IMPLEMENTATION DEPENDENCIES

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CC3015A	CC3106B>	<CC3120A	CC3120B	CC3121A	CC3123A	CC3123B
CC3125A	CC3125B	CC3125C	CC3125D>	<CC3126A	CC3127A	CC3128A
CC3203A	CC3207B	CC3208A	CC3208B>	<CC3208C	CC3220A	CC3221A

# IMPLEMENTATION DEPENDENCIES

CC3222A	CC3223A	CC3224A	CC3225A>	<CC3230A	CC3231A	CC3232A
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CC3408C	CC3408D	CC3504A	CC3504B	CC3504C	CC3504D	CC3504E
CC3504F>	<CC3504G	CC3504H	CC3504I	CC3504J	CC3504K>	<CC3601A
CC3601C>	<CC3603A	CC3606A	CC3606B	CC3607B>		

\* This test listed in two explanations

## CHAPTER 3

### PROCESSING INFORMATION

#### 3.1 TESTING ENVIRONMENT

The Ada implementation tested in this validation effort is described adequately by the information given in the initial pages of this report. For technical and sales information about this Ada implementation, contact:

Terry L. Dunbar  
TLD Systems, Ltd.  
3625 Del Amo Blvd.  
Suite 100  
Torrance, CA 90503

Testing of this Ada implementation was conducted at the customer's site by a validation team from the AVF.

#### 3.2 SUMMARY OF TEST RESULTS

An Ada Implementation passes a given ACVC version if it processes each test of the customized test suite in accordance with the Ada Programming Language Standard, whether the test is applicable or inapplicable; otherwise, the Ada Implementation fails the ACVC [Pro90].

For all processed tests (inapplicable and applicable), a result was obtained that conforms to the Ada Programming Language Standard.

The list of items below gives the number of ACVC tests in various categories. All tests were processed, except those that were withdrawn because of test errors (item b; see section 2.1), those that require a floating-point precision that exceeds the implementation's maximum precision (item e; see section 2.2), and those that depend on the support of a file system — if none is supported (item d). All tests passed, except those that are listed in sections 2.1 and 2.2 (counted in items b and f, below).

## PROCESSING INFORMATION

a) Total Number of Applicable Tests	3459	
b) Total Number of Withdrawn Tests	95	
c) Processed Inapplicable Tests	67	
d) Non-Processed I/O Tests	264	
e) Non-Processed Floating-Point Precision Tests	285	
f) Total Number of Inapplicable Tests	616	(c+d+e)
g) Total Number of Tests for ACVC 1.11	4170	(a+b+f)

### 3.3 TEST EXECUTION

A magnetic tape containing the customized test suite (see section 1.3) was taken on-site by the validation team for processing. The tests were grouped in bundles for more efficient processing.

After the test files were loaded onto the host computer, the full set of tests was processed by the Ada implementation.

The tests were compiled and linked on the host computer system, as appropriate. The executable images were transferred to the target computer system by the communications link described above, and run. The results were captured on the host computer system.

Testing was performed using command scripts provided by the customer and reviewed by the validation team. See Appendix B for a complete listing of the processing options for this implementation. It also indicates the default options. The options invoked explicitly for validation testing during this test were:

Options   Switch	Effect
No_Phase	Suppress displaying of phase times during compilation

All tests were executed with the Code Straightening, Global Optimizations, and automatic Inlining options enabled. Where optimizations are detected by the optimizer that represent deletion of test code resulting from unreachable paths, deleteable assignments, or relational tautologies or contradictions, such optimizations are reflected by informational or warning diagnostics in the compilation listings.

Test output, compiler and linker listings, and job logs were captured on magnetic tape and archived at the AVF. The listings examined on-site by the validation team were also archived.

# APPENDIX A MACRO PARAMETERS

This appendix contains the macro parameters used for customizing the ACVC. The meaning and purpose of these parameters are explained in [UG89]. The parameter values are presented in two tables. The first table lists the values that are defined in terms of the maximum input-line length, which is the value for \$MAX\_IN\_LEN--also listed here. These values are expressed here as Ada string aggregates, where "V" represents the maximum input-line length.

Macro Parameter	Macro Value
\$MAX_IN_LEN	120 -- Value of V
\$BIG_ID1	(1..V-1 => 'A', V => '1')
\$BIG_ID2	(1..V-1 => 'A', V => '2')
\$BIG_ID3	(1..V/2 => 'A') & '3' & (1..V-1-V/2 => 'A')
\$BIG_ID4	(1..V/2 => 'A') & '4' & (1..V-1-V/2 => 'A')
\$BIG_INT_LIT	(1..V-3 => '0') & "298"
\$BIG_REAL_LIT	(1..V-5 => '0') & "690.0"
\$BIG_STRING1	'"' & (1..V/2 => 'A') & "'"
\$BIG_STRING2	'"' & (1..V-1-V/2 => 'A') & '1' & "'"
\$BLANKS	(1..V-20 => ' ')
\$MAX_LEN_INT_BASED_LITERAL	'2:' & (1..V-5 => '0') & "11:"
\$MAX_LEN_REAL_BASED_LITERAL	"16:" & (1..V-7 => '0') & "F.E:"

## MACRO PARAMETERS

\$MAX\_STRING\_LITERAL    ' " ' & (1..V-2 => 'A') & ' "'

The following table lists all of the other macro parameters and their respective values.

Macro Parameter	Macro Value
\$ACC_SIZE	16
\$ALIGNMENT	4
\$COUNT_LAST	511
\$DEFAULT_MEM_SIZE	65536
\$DEFAULT_STOR_UNIT	16
\$DEFAULT_SYS_NAME	AF1750
\$DELTA_DOC	2.0**(-31)
\$ENTRY_ADDRESS	15
\$ENTRY_ADDRESS1	17
\$ENTRY_ADDRESS2	19
\$FIELD_LAST	127
\$FILE_TERMINATOR	ASCII.FS
\$FIXED_NAME	NO_SUCH_FIXED_TYPE
\$FLOAT_NAME	NO_SUCH_FLOAT_TYPE
\$FORM_STRING	" "
\$FORM_STRING2	"CANNOT RESTRICT FILE CAPACITY"
\$GREATER_THAN_DURATION	90000.0
\$GREATER_THAN_DURATION BASE LAST	I31073.0
\$GREATER_THAN_FLOAT BASE LAST	1.71000E+38
\$GREATER_THAN_FLOAT SAFE LARGE	2.I3000E+37

# MACRO PARAMETERS

```

$GREATER_THAN_SHORT_FLOAT_SAFE_LARGE
    NO_SUCH_SHORT_FLOAT_TYPE

$HIGH_PRIORITY        64

$ILLEGAL_EXTERNAL_FILE_NAME1
    BADCHAR@.!

$ILLEGAL_EXTERNAL_FILE_NAME2
    THISFILENAMEWOULDBEPERFECTLYLEGALIFITWERENOTSOLONG.SOTHERE

$INAPPROPRIATE_LINE_LENGTH
    -1

$INAPPROPRIATE_PAGE_LENGTH
    -1

$INCLUDE_PRAGMA1      PRAGMA INCLUDE ("A28006D1.TST")
$INCLUDE_PRAGMA2      PRAGMA INCLUDE ("B28006D1.TST")

$INTEGER_FIRST        -32768
$INTEGER_LAST         32767
$INTEGER_LAST_PLUS_1  32768

$INTERFACE_LANGUAGE   ASSEMBLY

$LESS_THAN_DURATION   -90000.0
$LESS_THAN_DURATION_BASE_FIRST
    -131073.0

$LINE_TERMINATOR      ASCII.CR

$LOW_PRIORITY         1

$MACHINE_CODE_STATEMENT
    R_FMT' (OPCODE=>LR,RA=>R0,RX=>R2);

$MACHINE_CODE_TYPE     ACCUMULATOR

$MANTISSA_DOC          31

$MAX_DIGITS            9

$MAX_INT               2147483647
$MAX_INT_PLUS_1        2147483648

$MIN_INT               -2147483648

$NAME                  NO_SUCH_INTEGER_TYPE

A-3

```



# MACRO PARAMETERS

\$NAME_LIST	none, nsl6000, vax, af1750, z8002, z8001, gould, pdp11, m68000, pe3200, caps, amdahl, i8086, i80286, i80386, z80000, ns32000, ibms1, m68020, nebula, name_x, hp
\$NAME_SPECIFICATION1	NOT_SUPPORTED
\$NAME_SPECIFICATION2	NOT_SUPPORTED
\$NAME_SPECIFICATION3	NOT_SUPPORTED
\$NEG_BASED_INT	16#FFFFFFFFE#
\$NEW_MEM_SIZE	65535
\$NEW_STOR_UNIT	16
\$NEW_SYS_NAME	af1750a
\$PAGE_TERMINATOR	ASCII.CR & ASCII.FF
\$RECORD_DEFINITION	RECORD OPCODE: R_OPCODE_VALUE; RA: REGISTER; RX: REGISTER:=R0; END RECORD;
\$RECORD_NAME	R_FMT
\$TASK_SIZE	16
\$TASK_STORAGE_SIZE	2000
\$TICK	1.0/10000.0
\$VARIABLE_ADDRESS	16#8000#
\$VARIABLE_ADDRESS1	16#8020#
\$VARIABLE_ADDRESS2	16#8040#
\$YOUR_PRAGMA	NO_SUCH_PRAGMA

APPENDIX B  
COMPILATION SYSTEM OPTIONS

The compiler options of this Ada implementation, as described in this Appendix, are provided by the customer. Unless specifically noted otherwise, references in this appendix are to compiler documentation and not to this report.

LINKER OPTIONS

The linker options of this Ada implementation, as described in this Appendix, are provided by the customer. Unless specifically noted otherwise, references in this appendix are to linker documentation and not to this report.

Example: With the logical name definition

```
$ DEFINE ADA_DEFAULTS "/LIST/MAC/NOCHECKS"
```

the Ada compiler invocation command

```
$ ADATLD/DEBUG TEST
```

is expanded to

```
$ ADATLD/LIST/MAC/NOCHECKS/DEBUG TEST
```

by the compiler.

---

### 3.4 COMPILER OPTION SWITCHES

Compiler option switches provide control over various processing and output features of the compiler. These features include several varieties of listing output, the level and kinds of optimizations desired, the choice of target computer, and the operation of the compiler in a syntax checking mode only.

Keywords are used for selecting various compiler options. The complement keyword, if it exists, is used to disable a compiler option and is formed by prefixing the switch keyword with "NO".

Switches may be abbreviated to the number of characters required to uniquely identify the switch. For example, the switch "CROSSREF" (explained in the list below) may be uniquely identified by the abbreviation "CR" or any longer abbreviation. In the list of switches, on the following pages, the abbreviations are in bold, the optional extra characters are not bolded.

If an option is not specified by the user, a default setting is assumed. All specified compiler options apply to a single invocation of the compiler.

The default setting of a switch and its meaning are defined in the table below. The meaning of the complement form of a switch is normally the negation of the switch. For some switches, the complement meaning is not obvious; these complement switch keywords are listed separately.

In the description of the switches, the target dependent name `target` is used. The value of this symbol is determined by the value of the TARGET switch.

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**COMPILER USAGE**

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Compiler generated file specifications generally conform to host conventions. Thus, any generated filename is the source filename appended with the default file type. The output file name can be completely or partially specified.

SWITCH NAME

MEANING

16BADDR  
32BADDR

-- default

The 32BADDR option causes address computations to be performed using 1750A double precision fixed point data words. If 16BADDR is selected, address computations will be performed using single precision fixed point data words ignoring the possibility of a 1750A Fixed Point Overflow Interrupt due to computation of an address greater than 7FFF hex. Applicable to 1750A target only.

ASM (-emulation-file-spec)  
NOASM -- default

The ASM switch selects an assembler output file which contains VAX macro references for assembling and emulation of the target on the VAX (1750A target only).

If no emulation-file-spec is specified, the file name is formed from the file name of the input-file-spec with the file type ".MAR". If only the emulation-file name is specified, a file type of ".MAR" is added to form the full file name. If only the file type is specified, the file name of the input-file-spec is used with the specified file type to form the full file name.

The ASM switch overrides an earlier ASSEMBLY or MACRO switch.

CALL TREE  
NOCALL\_TREE -- default

This switch is used in conjunction with /ELABORATE and /LIST to cause all .CTI files (corresponding to the complete set of object files being linked for this program) to be read in and a closure of all calls in the program to be computed. The results of this analysis is formatted into a subprogram call tree report.

Note: The call tree will be incomplete if any required compilation unit's .CTI files are missing.

**CHECKS** -- default  
**CHECKS**=(check\_identifier(...))  
**NOCHECKS**=(check\_identifier(...))

When the **CHECKS** switch is used, one or more **check\_identifiers** are specified and the specified run time checks are enabled. The status of run time checks associated with unmentioned **check\_identifiers** is unchanged.

Without any **check\_identifiers**, the **NOCHECKS** switch omits all run time checks. If one or more **check\_identifiers** are specified, the specified run time checks are omitted. The status of run time checks associated with unmentioned **check\_identifiers** is unchanged.

Checks can be eliminated selectively or completely by source statement pragma **Suppress**. Pragma **Suppress** overrides the checks switch.

**Check\_identifiers** are listed below and are described in the LRM, Section 11.7.

<b>ACCESS_CHECK</b>	<b>DISCRIMINANT_CHECK</b>	<b>DIVISION_CHECK</b>
<b>ELABORATION_CHECK</b>	<b>INDEX_CHECK</b>	<b>LENGTH_CHECK</b>
<b>OVERFLOW_CHECK</b>	<b>RANGE_CHECK</b>	<b>STORAGE_CHECK</b>

**CONFIG**=value  
**NOCONFIG**=value

The **CONFIG** switch provides a conditional compilation (configuration) capability by determining whether or not source text, introduced or bracketed by special comment constructs, is compiled. For a single line:

--/value source-text

where source-text is compiled only if config = value is specified.

For multiple lines:

--/value line-1

--/value line-2

·  
·  
·

--/value line-n

where the construct

```
--/value    line-1
```

```
            line-2
```

```
      .      .  
      .      .  
      .      .
```

```
--/value    line-n
```

is equivalent.

NOTE: The braces ( ( and ) ) must appear in the source code; in this instance, they are not meta-characters. All of the text between -- / (value and --- / ) value is compiled or skipped, depending upon whether or not the config-value is present.

**CROSSREF**  
**NOCROSSREF** -- default

This switch generates a cross reference listing that contains names referenced in the source code. The cross reference listing is included in the listing file; therefore, the LIST switch must be selected or CROSSREF has no effect.

**CSEG** -- default  
**NOCSEG**

This switch indicates that constants are to be allocated in a control section of their own (1750A target only).

**CTI** (-CTI-file-spec)  
**NOCTI** -- default

This switch generates a CASE tools interface file. The default filename is derived from the object filename, with a .CTI extension. This switch is required to support the Stack Analysis and/or Call Tree switches.

**DEBUG** -- default  
**NODEBUG**

This switch selects the production of symbolic debug tables in the relocatable object file.

Alternate abbreviation: **DBG, NODBG**

**DELAASSIGN** -- default  
**NODELAASSIGN**

This switch optimizes code by deleting redundant assignments.

NOTE: Use of this switch can cause erroneous source programs to execute with unexpected results if references to access objects are made without regard to the interference semantics of Ada.

**DIAGNOSTICS** -- default  
**NODIAGNOSTICS**

The **DIAGNOSTICS** switch produces a file compatible with Digital's Language Sensitive Editor and the XinoTech Composer. See Digital's documentation for the Language Sensitive Editor for a detailed explanation of this switch.

?  
?  
?  
?

**ELABORATOR**

This switch selects generation of a setup program that elaborates all compilation units on which the named subprogram depends and then calls the named program. This program will be the main program at link time.

**EXCEPTION\_INFO**  
**NOEXCEPTION\_INFO** -- default

This switch generates a string in the relocatable object code that is the full pathname of the file being compiled. It generates extra instructions to identify the location at which an unhandled exception occurred. The **NOEXCEPTION\_INFO** switch suppresses the generation of the string and extra instructions. The source statement `pragma Suppress (ALL_CHECKS)` or `pragma Suppress (EXCEPTION_INFORMATION)` suppresses only the extra instructions.



**FULL\_CALL\_TREE** -- default

When the **FULL\_CALL\_TREE** switch is used, the compiler listing includes representations of every call.

?  
?

**INDENT-n**

**INDENT-3** -- default

This switch produces a formatted (indented) source listing. This switch assigns a value to the number of columns used in indentation; the value n can range from 0 to 15.

**INDIRECT**

**NOINDIRECT** -- default

If this switch is used, all subprograms declared in the compilation are called with indirect calls. This switch only applies to the 1750A target.

**INFO** -- default

**NOINFO**

This switch produces all diagnostic messages. It suppresses the production of information-level diagnostic messages.

**INLINE** -- default

**NOINLINE**

This default switch automatically inlines any procedure that is called only once. It may be disabled by adding the noinline option to the command line. Inlining is only implemented for calls that are made within the same compilation unit as the body of the procedure to be expanded.

?  
?  
?  
?  
?

**INTSL**

**NOINTSL** -- default

This switch intersperses lines of source code with the assembly code generated in the macro listing. This switch is valid only if the **LIST**, **SOURCE**, and **MACRO** switches are selected, and one of the **MACRO**, **ASM**, or **ASSEMBLY** switches is selected. The **MACRO** switch overrides an earlier **ASSEMBLY** or **ASM** switch.

?  
?  
?  
?  
?

**LIBRARY-Ada-program-library-file-spec**

**LIBRARY-target.LIB** -- default

This switch identifies the file to be used for Ada Program Library. The default value of target in the Ada Program Library file spec is derived from the **TARGET** switch.

**LIST**(-listing-file-spec)  
**NOLIST** -- default in interactive mode  
**LIST** -- default for background processes

The **LIST** switch generates a listing file. The default file type is **.LIS**. The listing-file-spec can be optionally specified.

**LOG**  
**NOLOG** -- default

This switch requests the compiler to write a compiler log, including command line options and the file spec of the Ada source file being compiled, to **SY\$OUTPUT**.

**MACRO**  
**NOMACRO** -- default

The **MACRO** switch produces an assembly like object code listing appended to the source listing file. The **LIST** switch must be enabled or this switch has no effect.

**MAIN\_ELAB**  
**NOMAIN\_ELAB** -- default

The **MAIN\_ELAB** switch is used to inform the compiler that the compilation unit being compiled is to be treated as a user-defined elaboration, or setup, program.

Note: The **XTRA** switch is required when **MAIN\_ELAB** is to be used.

**MAKELIB**(-parent-APL-spec)  
**NOMAKELIB** -- default

The **MAKELIB** switch creates a new Ada Program Library (APL) file. **MAKELIB** should be used with caution because it creates a new APL file in the default directory even if another APL file of the same name existed.

The new APL file is created in the default directory with the name **target.LIB** unless the **LIBRARY** switch is used.

If **MAKELIB** is used without a parent, a new library is created with the default RTS specification. This specification is derived from the name **TLD\_LIB\_target**. See the target dependent compiler sections for further explanations of this name.

MAXERRORS=*n*  
MAXERRORS=500 -- default

This switch assigns a value limit to the number of errors forcing job termination. Once this value is exceeded, the compilation is terminated. Information-level diagnostic messages are not included in the count of errors forcing termination. The specified value's range is from 0 to 500.

MODEL= <i>model</i>	-- 1750A target
MODEL-STANDARD	-- default
MODEL-VAMP	
MODEL-IBM_GVSC	-- IBM_GVSC target
MODEL-HWELL_GVSC	-- Honeywell_GVSC target
MODEL-HWELL_GVSC_FPP	-- Honeywell_GVSC target (with floating point processor)
MODEL-RWELL_ECA	-- Rockwell Embedded Compiler architecture
-R11750AB	-- Rockwell International 1750A/B architecture
MODEL-MA31750	-- Marconi 31750 architecture
MODEL-PACE_1750AE	-- PACE 1750AE architecture
MODEL-MS_1750B_II	-- MIL-STD-1750B, Type II
-MS_1750B_III	-- MIL-STD-1750B, Type III
MODEL-MDC281	-- Marconi MDC281

By default, the compiler produces code for the generic or standard target. The model switch allows the user to specify a nonstandard model for the target.

For the 1750A target, MDC281 switch selects the MDC281 (MAS 281) implementation of MIL-STD-1750A.

OBJECT(*-object-file-spec*)  
OBJECT -- default  
NOOBJECT

The OBJECT switch produces a relocatable object file. The default file type is ".OBJ".

OPT -- default  
NOOPT

The OPT switch enables global optimization of the compiled code.

**PAGE-n**  
**PAGE-60 -- default**

The PAGE switch assigns a value to the number of lines per page for listing. The value can range from 10 to 99.

**PARM**  
**NOPARM -- default**

The PARM switch causes all option switches governing the compilation, including the defaulted option switches, to be included in the listing file. The LIST option must also be selected or PARM will have no effect. User specified switches are preceded in the listing file by a leading asterisk (\*).

**PHASE -- default**  
**NOPHASE**

The NO\_PHASE switch suppresses the display of phase names during compilation.

**REF\_ID\_CASE-option**

The Ref\_Id\_Case switch is used to determine how variable names appear in the compiler listing. The options for this switch are:

All_Lower	-- All variable names are in lower case.
All_Underlined	-- All variable names are underlined.
All_Upper	-- All variable names are in upper case.
As_Is	-- All variable names appear as is.
Initial_Caps	-- All variable names have initial caps.
Insert_Underscore	-- All variable names have underscores inserted.

**REF\_KEY\_CASE-option**

The Ref\_Key\_Case switch is used to determine how Ada key words appear in the compiler listing. The options for this switch are:

All_Lower	-- All Ada key words are in lower case.
All_Underlined	-- All Ada key words are underlined.
All_Upper	-- All Ada key words are in upper case.
As_Is	-- All Ada key words appear as is.
Initial_Caps	-- All Ada key words have initial caps.
Insert_Underscore	-- All Ada key words have underscores inserted.

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## COMPILER USAGE

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REFORMAT(-reformat-file-spec)  
NOREFORMAT -- default

This switch causes TLDada to reformat the source listing in the listing file and, if a reformat-file-spec is present, to generate a reformatted source file. The default type of the new source file is ".RFM".

SOURCE -- default  
NOSOURCE

This switch causes the input source program to be included in the listing file. Unless they are suppressed, diagnostic messages are always included in the listing file.

STACK\_ANALYSIS  
NOSTACK\_ANALYSIS -- default

This switch is used with the ELABORATOR switch to cause all CTI files (corresponding to the complete set of object files being linked for this program) to be read in. The subprogram call tree is analyzed to compute stack requirements for the main program and each dependent task.

NOTE: The tree will be incomplete if any required compilation unit's CTI files are missing.

SYNTAX\_ONLY  
NOSYNTAX\_ONLY -- default

This switch performs syntax and semantic checking on the source program. No object file is produced and the MACRO switch is ignored. The Ada Program Library is not updated.

TARGET-1750A -- default  
TARGET-VAX -- default

This switch selects the target computer for which code is to be generated for this compilation. "1750A" selects the MIL-STD-1750A Instruction Set Architecture, Notice A. "VAX" selects the VAX architecture operation under VMS.

WARNINGS -- default  
NOWARNINGS

The WARNINGS switch outputs warning and higher-level diagnostic messages.

The NOWARNINGS switch suppresses the output of both warning-level and information-level diagnostic messages.

WIDTH-n  
WIDTH-110 -- default

This switch sets the number of characters per line (80 to 132) in the listing file.

WRITE\_ELAB  
NOWRITE\_ELAB -- default

The WRITE\_ELAB switch is used to obtain an Ada source file which represents the main elaboration "setup" program created by the compiler. The MAIN\_ELAB switch may not be used at the same time as the ELAB switch.

XTRA  
NOXTRA -- default

This switch is used to access features under development. See the description of this switch in Section 3.9.

## 4. DIRECTIVE LANGUAGE

---

TLDlnk is called by a command which may specify options in a form which is host dependent. See Chapter 5 for a description of the command line on a specific host computer. On each host, one of the options is to specify a linker directive file which is host independent. This section describes the directives which may appear in a linker directive file to control a link operation.

### 4.1 DIRECTIVE FILE

---

Each line of the Directive File contains up to 132 characters. Tabs are treated as blanks. Blanks are necessary to separate words when no other punctuation would otherwise separate them, but the number of blanks used is insignificant. Any characters after two successive minuses (--) are ignored. A directive ordinarily consists of one line of input, but an opening parenthesis, "(" or "<", which is unmatched on one line causes all following lines to be included in the same directive until the closing parenthesis, ")" or ">", is found, permitting long parenthesized lists. Words may not be divided between lines. Only one directive is allowed per input line. Either upper or lower case may be used; upper and lower case are equivalent. In the following list of directives and components (e.g., directive attributes), the acceptable abbreviation for a directive is in bold and may be used instead of the entire directive or component name. For example, the CSECT directive attribute **WRITEPROTECT** may be entered as "W."

### 4.2 DIRECTIVES

---

TLDlnk directives are individually described in this section and appear in alphabetical order. For discussions of related directives, refer to Sections 3.2 -3.8, in Chapter 3.

In the following descriptions, upper case Roman font is used for keywords and lower case italics indicates information provided by the user, e.g., ADDRESS STATES *decimal*.

Characters inside curly ( ) braces are optional, the user may enter or omit them. Rectangular braces with a vertical bar inside represent a choice; [X|Y] indicates that the user may enter X or Y, but not both.

The - symbol is used for a convenient line break. It is not part of the syntax.

In these descriptions, directive switches are shown with "\*" as the lead-in character. For VAX or MV hosted systems, the user should replace "\*" with "/". For UNIX hosted systems, "\*" should be replaced with "-". For example, the "\*TRANSIT" switch (in the NODE description) is entered as "/TRANSIT" for VAX systems, or "-TRANSIT" for UNIX systems.

The following words, in lower case italics, are used in the descriptions:

*file*

This is a host file specification. A file specification must be completely contained on a line.

*node*

This is the name of a node in the program being linked.

*module*

This is the name of a module in the program being linked.

*symbol*

This is the name of an external symbol in the program being linked.

*laddress*

This is a logical address, in the form (a.)n[I|O]. In the address, a is a hexadecimal digit giving the address state (default 0), n is a hexadecimal number from 0 to FFFF giving the address within the address state, and I or O (upper or lower case) specifies instruction or operand.

*paddress*

This is a physical address in the form of a hexadecimal number from 0 to FFFFF.

*address*

This is a logical or physical address.



*lpage*

This is a logical page number in the form (a.)n(I|O). In the address, a is the address state (default 0), n is a hexadecimal number from 0 to F giving the page number within the address state, and I or O indicates instruction or operand.

*ppage*

This is a physical page number in the form of a hexadecimal number from 0 to FF.

*decimal*

This is a decimal number.

Each TLDlnk directive is described below.

**ADDRESS STATES** *decimal*

This directive declares the number of page registers which the program being linked is expected to use. If the number is 0, TLDlnk assumes that there are no page registers, and memory mapping is not supported.

If this directive is absent, TLDlnk assumes that the program being linked uses 16 Address States.

**ASSIGN** *lpage,ppage(,number-pages)*

The ASSIGN directive causes TLDlnk to assign the specified logical page(s) to the specified physical page(s). The assignment begins at lpage and ppage and continues with consecutive logical and physical pages until number-pages have been assigned. If number-pages is omitted, the default is 1 page. The ASSIGN directive is required for all physical pages specified in ROM directives if ADDRESS STATES is greater than zero.

**CINCLUDE** *file((module((csect,...))(-symbol,...),...))(-symbol,...)*

CINCLUDE, the conditional INCLUDE directive, is no longer supported. Use the INCLUDE directive instead.

**COLLECT NODE** - *node\_name* ([ATTR=*attribute*|NAME=*csect\_name*])

The **COLLECT NODE** directive collects control sections by attribute or name and moves them to the specified node. The control sections collected are those between the last **NODE** directive and the **COLLECT** directive which have the specified attribute or control section name.

**COMMENT** - *"Text to be put in Load Module"*

The **COMMENT** directive contains text which TLDlnk puts in the load module. TLDlnk precedes the text within quotes by *"/;"* to distinguish user inserted comments from those inserted by TLDlnk (which begin with *"/;"*). All comments specified by **COMMENT** directives are inserted in the load module immediately following the initial comment which is created by TLDlnk.

#### **CONTINUATION**

The **CONTINUATION** directive indicates that the character following the directive is a continuation line mark for the current directive file and all nested directive files. A continuation line mark is used when more information is needed to complete the current line.

The default continuation marks are operating system-specific: the continuation line mark for computer systems running on UNIX is *"\"*, for VAX/VMS it is *"-"*, and the mark for AOS/VS systems is *"&."* Continuation line mark characters are set for a directive file when the **CONTINUATION** directive is followed by the appropriate continuation character.

A continuation line mark must be preceded by a space. The mark cannot cross file boundaries. Continuation line marks only affect lines within the same directive file.

For example, a continuation line in UNIX might look like:

```
store 888 - 1,2,3,4,5,6,7,8,9,10,11,12,13,14, \  
15,16,17
```

and is equivalent to:

```
store 888 - 1,2,3,4,5,6,7,8,9,10,11,12,13,14  
store 896 - 15,16,17
```

A continuation line mark may also be used to place a comment, for example:

store 888 = 1,2,3,4,5,6,7,8,9,10,\-- comment here  
11,12,13

NOTE: If the continuation character "-" is to be used in other contexts (e.g., using it on the VAX to exclude symbols on an INCLUDE directive), then the CONTINUATION directive must be used to change the default continuation character.

**CSECT** *module*, **csect**([, *address* | **ALIGN**=*n*)] (**ATTR**=*attribute-list*)

The CSECT directive specifies the address or alignment and/or the attributes of a control section. The module and csect name are required to identify the control section uniquely. Either address or alignment, but not both, may be specified. If address is specified, it is given as a single hexadecimal number. TLDlnk interprets the address as physical if ADDRESS STATES is 0; otherwise, TLDlnk interprets the address as an instruction address or operand address according to the control section attribute. The attributes are identified below. In this list, the characters in bold must be entered, the remaining plain text characters are optional. Italics indicates information provided by the user.

- |                        |  |
|------------------------|--|
| <b>WRITEPROTECT</b>    | Allocate this control section to a page covered by a page register with the write protect bit on.                  |
| <b>NOTWRITEPROTECT</b> | Allocate this control section to a page covered by a page register with the write protect bit off.                 |
| <b>BLOCKPROTECT</b>    | Allocate this control section to a 1024-word block protected from processor access by a bit in memory-protect RAM. |
| <b>NOTBLOCKPROTECT</b> | Allocate this control section to a 1024-word block with processor access allowed by a bit in memory-protect RAM.   |
| <b>DMAPROTECT</b>      | Allocate this control section to a 1024-word block protected from DMA access by a bit in memory-protect RAM.       |

**NOTDMAPROTECT**      Allocate this control section to a 1024-word block with DMA access allowed by a bit in memory-protect RAM.

**STARTROM**            Allocate this control section to a page designated as startup ROM by a ROM linker directive.

**RAM\_OR\_ROM**          Allocate this control section to a page designated as RAM\_OR\_ROM by a ROM linker directive, or if there is no such linker directive or not enough room in the ROM, allocate this control section to RAM.

**ROM\_ONLY**            Allocate this control section to a page designated as ROM\_ONLY by a ROM linker directive.

**RAM\_ONLY**            Allocate this control section to a page not designated as ROM by a linker directive.

**DEBUG**

DEBUG causes the linker to create a file containing symbols and their values for use by the symbolic debugger. The linker puts all external symbols in the symbol file and any local symbols which were included in the Relocatable Object File by the compiler or assembler. If no file-spec is specified, the name of the symbol file is derived as described in the MAP switch. If DEBUG is not specified, the linker does not produce the symbol file.

DEBUG causes a TLD Symbol File (.sym) to be generated when LDMTYPE = LDM or LLM is specified. DEBUG causes the HP Linker Symbol Files (.L) and an Assembler Symbol File (.A) to be generated whenever LDMTYPE=HP is specified.

**END**

This directive is always required. In a file specified in a USE directive it terminates directive input from that file. In the primary directive file, it terminates directive input to TLDlnk, so that any subsequent input is ignored. After this directive is read, TLDlnk allocates memory and reads the object files to produce the load module.

**ENTRY MODULE** (-)symbol,...

The option to have TLDlnk produce an entry module file is specified in the command line. See Chapter 5 for a description of the command line options.

If the option to produce an entry module file is specified in the command line, then an ENTRY MODULE directive may be used in the directive file to restrict the entry points which are defined in the entry module file. If the ENTRY MODULE directive does not appear, all external symbols defined in the link are defined in the entry module file. If the ENTRY MODULE directive is used, it must precede any NODE directive.

The symbols listed inside angle brackets in this directive are all preceded by a minus sign, or are all not preceded by a minus sign. If the symbols are not preceded by a minus sign, then only the symbols given are defined in the object module. If the symbols are preceded by a minus sign, then all the entry points in the node except the symbols given are defined in the object module.

**EXCLUDE** file ((module,...))

EXCLUDE, a directive which includes a file while excluding selected modules, is no longer supported. Use the INCLUDE directive instead.

```
INCLUDE(*COND)[file((module_symbol_list)) | file((module_list))-
                (<symbol_list>)]

module_symbol_list ::=

module ((csect_list))(<symbol_list>)(,module((csect_list))-
                (<symbol_list>))

module_list ::=

module [((csect_list))(<symbol_list>)(,module((csect_list))-
                | module(,-module))]

csect_list ::= csect(,csect...) | -csect(,-csect...)

symbol_list ::= symbol(,symbol...) | -symbol(,-symbol...)
```

BNF notation is used above to express the complicated syntax of the INCLUDE directive.

This directive causes the specified file to be included in the load module. If any module names are listed in parentheses, all the names must be prefixed with minus signs or none of them may have minus signs. If the module names are preceded by a minus sign, then those object modules are excluded from the load module. If the module names are not preceded by a minus sign, then only the named modules are included in the load module. In either case, the order of the module names is not significant. If no modules are listed in parentheses, then the entire file is included.

If module names are listed without minus signs, each module name may be followed by individual control section names in parentheses following the module name. If any control sections are listed, all the control sections must be prefixed by minus signs or none of them may have minus signs. If control section names are preceded by minus signs, those control sections are excluded from the link. If control section names are not preceded by minus signs, only the named control sections are included in the link. If no list of control section names follows a module name, the entire module is included in the link.

If module names are not listed, or if module names are listed without minus signs, individual external symbol definitions may be included or excluded from individual modules or from the entire file by listing the symbol names, optionally prefixed with minus signs, and enclosed in angle brackets (<>). If a symbol list follows a module name (and its optional list of control section names), the specified symbols are

included or excluded from the module. If a symbol list follows the file name (and the optional list of module names), the specified symbols are included or excluded from the entire file. Symbols may be excluded or included in a directive line, but not both. If the \*COND qualifier is used, then the specified modules are included in the load module only if they have not already been included.

**INDIRECT** (\*ADDRESS = address)(\*ROMADDRESS = address ) symbol,...

The INDIRECT directive specifies symbols that are accessed indirectly, through a branch vector. In this vector, symbols are ordered the same way that they are in the symbol list. The ADDRESS qualifier provides the starting address of the transfer vector. This must be a physical address. The ROMADDRESS qualifier specifies the starting address of a copy of the transfer vector in ROM.

A symbol may only appear once in an INDIRECT symbol list. However, multiple definitions of these are permitted in the object code to permit replacement of procedures. When multiple definitions are used, the transfer vector contains a branch to the last procedure encountered, and no diagnostic is issued.

For more information, see the discussion of "Reprogramming" in Section 3.2.8 of this manual.

**LDMTYPE**=format(,format...)

**LDMTYPE**=LDM -- default

**LDMTYPE**=LLM

**LDMTYPE**=HP

LDMTYPE specifies the format of the load module and symbol file(s) TLDlink is to produce. Three formats are currently available. If more than one format is specified, the members of the list are separated by commas. See DEBUG for related information.

- o LDM (file extension .LDM), the default, specifies the TLD Load Module Format.
- o LLM (file extension .LLM) specifies a format that is similar to the TLD Load Module Format, but with logical addresses instead of physical addresses. See Section 3.10.
- o HP (file extension .X) specifies the Hewlett-Packard HP64000 Absolute File format.

**LET** (\*MEMORY\_TYPE - "memory type name") symbol - value

The LET directive causes the linker to set the specified symbol to the specified value. The effect is as if the symbol had been defined as an EXPORT in an object module. Any external reference to the specified symbol from an object module will be set to the value specified in the LET directive. Optionally, a symbol type can be declared as a specific memory type if MEMORY\_TYPE is set - "memory type name."

**MAXADR** address

This directive gives the maximum physical address the program is expected to use. If the directive is not used, it is assumed that all 0..FFFF (hexadecimal) locations are available, except those reserved by the RESERVE directive. If the linked program extends beyond the specified address, it is linked with a warning.

**MEMORY BLOCK PROTECT**

This directive announces that the block protect RAM is available on the target processor, permitting hardware memory protection in increments of 1024 words. If this directive is present, values for loading in memory-protect RAM are included in the load module. If this directive is absent, TLDlnk assumes that there is no block protect RAM.

**NODE**(\*{NO}TRANSIT(-Transit\_Name){\*STARTROM)  
(\*ADDRESS=address | \*ALIGN=address) node(,node)

The NODE directive declares that all control sections included up to the next NODE or END directive are contained in the same node. All control sections in a node are visible at the same time.

The TRANSIT switch is used to specify transit routine options. The default is TRANSIT. If NOTRANSIT is used, the insertion of transit routines is suppressed for calls originating from another node to entry points within this node. If Transit\_Name is used, the named transit routine is inserted for all calls originating from another node to entry points within this node.

The STARTROM switch indicates that the contents of this node are to be placed in startup ROM. This switch inserts a /V STARTROM record before the contents of this node in the load module.



The ADDRESS or ALIGN switch, but not both, may be used to specify the start address or the alignment of the first module in the node. If ADDRESS STATES is greater than 0, then the address may be an instruction address, or an operand address, or both.

The first node name is the name of this node. It can duplicate the name of any symbol, file, or module, or it can be a new name. The second node name is the name of the parent of this node. When there is no parent (i.e., for a root node) the second node name is omitted. The same name must not be used as the node name in two NODE directives. The parent node must precede its descendant nodes. NODE directives must be ordered such that no node is separated from its parent node by only its sibling nodes and their descendant nodes.

**NOLOAD** *address, address*

The NOLOAD directive causes code or data within the specified range to be omitted from the load module. This directive may occur repeatedly to specify multiple ranges. If ADDRESS STATES is 0, the addresses must be physical. If ADDRESS STATES is greater than 0, the addresses may be logical or physical.

NOTE: NOLOAD may be used to suppress generation of code or data that is already in ROM but is referenced by new and or replacement code.

**RESERVE** *address, address*

This directive announces that no relocatable control sections are to be loaded into the specified range of addresses. Absolute control sections are loaded without regard to reserved areas. Addresses beyond the MAXADR address are treated as reserved. This directive may occur repeatedly for multiple reserved ranges.

If ADDRESS STATES is 0, then the addresses must be physical addresses. If ADDRESS STATES is greater than 0, then the addresses may be logical addresses or physical addresses, but all RESERVES with physical addresses must precede the first NODE directive.

ROM(*switch\_list*) *paddress*,*paddress*

This directive restricts the given range of physical addresses to control sections designated as read-only memory. All other memory is treated as readable and writeable. This directive may occur repeatedly for separate ROM ranges. If ADDRESS STATES is greater than 0, the ASSIGN directive must specify the logical pages which are to be assigned to all ROM physical pages.

The following list identifies switches that are used to specify attributes of control sections which are allocated to ROM. The attributes of O/I and RAM/ROM are checked for all relocatable control sections. The O/I attribute can have two values: Operand or Instruction. The RAM/ROM attribute can have three values: RAM\_ONLY, ROM\_ONLY, or RAM\_OR\_ROM.

- \*S Restricts this ROM range to control sections with attribute STARTROM.
- \*IR Restricts this ROM range to control sections with attributes Instruction and ROM\_ONLY.
- \*IRR Restricts this ROM range to control sections with attributes Instruction and RAM\_OR\_ROM.
- \*OR Restricts this ROM range to control sections with attributes Operand and ROM\_ONLY.
- \*ORR Restricts this ROM range to control sections with attributes Operand and RAM\_OR\_ROM.

Switches can be combined and the combined attributes will be selected. In addition, the following are switches that specify combinations of attributes:

- \*I** Has the same effect as **\*IR\*IRR**. Restricts this ROM range to control sections with attributes **Instruction** and **ROM\_ONLY** or **RAM\_OR\_ROM**.
- \*O** Has the same effect as **\*OR\*ORR**. Restricts this ROM range to control sections with attributes **Operand** and **ROM\_ONLY** or **RAM\_OR\_ROM**.
- \*R** Has the same effect as **\*IR\*OR**. Restricts this ROM range to control sections with attribute **ROM\_ONLY** regardless of the **O/I** attribute value.
- \*RR** Has the same effect as **\*IRR\*ORR**. Restricts this ROM range to control sections with attribute **RAM\_OR\_ROM** regardless of the **O/I** attribute value.

If no switches are specified, control sections with attributes **ROM\_ONLY** or **RAM\_or\_ROM** are allocated to ROM.

**SEARCH(\*REPEAT)(\*NODE=Node\_Name) file**

This directive causes TLDlnk to search the specified file for modules which define currently undefined external references. Any such modules are included just as if they had been specified in an **INCLUDE** directive. Undefined weak external references do not cause inclusion on a search, but if an external is both weakly and strongly referenced, its defining module is loaded by **SEARCH**. New external references from modules included from the search file can cause additional modules to be included from the search file, regardless of the order of modules in the search file. For example, if the program references only **S**, and **3** references **T**, and the library contains **T** followed by **S**, then both **S** and **T** are included from the library.

The **REPEAT** switch has two effects. First, it causes TLDlnk to search the file when the **END** directive is encountered instead of when the **SEARCH** directive is encountered. Second, the set of files which appear in **SEARCH\*REPEAT** directives is searched repeatedly to try to define new undefined external references from any module included from any file in the set. The **REPEAT** switch allows the use of multiple libraries which have interlibrary references.

The **NODE** switch causes TLDlnk to insert any modules included as a result of the search in the specified node. If the **NODE** switch is not used, the modules are inserted in the node in which the **SEARCH** occurs, or if the **REPEAT** switch is used, in the last node of the link.

**STORE** [*symbol* | *address*] = [*symbol* | *value* | SUM](,...)

The STORE directive indicates that TLDlnk is to cause one or more values to be stored in memory when the program being linked is loaded. The starting location at which values are to be stored is specified either as an address or an external symbol. If ADDRESS STATES is 0, then the address must be a physical address. If ADDRESS STATES is greater than 0, then the address may be a logical address or a physical address. Each value to be stored is specified as a hexadecimal number, or as an external symbol, or as the SUM function described below. TLDlnk causes the first value to be stored in the specified address when the program is loaded into memory. If more than one value is given, the succeeding values are stored in consecutive addresses following the specified address. Without a warning, the values stored in memory by the STORE directive overwrite any other values stored at the same locations.

**SUM** (*startadr*, *endadr*, *result*, *skipadr*)

The purpose of the SUM function is to return a checksum value. The SUM function returns a value equal to *result* minus the sum of all words from *startadr* to *endadr* with the exception of the word at *skipadr*. Any overflows are ignored in taking the sum. The SUM function is intended to be used with the STORE directive to compute a value to be stored at *skipadr*. This is computed the following way:

$$\text{SUM} = \text{result} - \text{sum}(\text{endadr} - \text{startadr}) - (\text{skipadr})$$

If ADDRESS STATES is 0, then all the addresses used in the SUM function must be physical addresses. If ADDRESS STATES is greater than 0, the addresses may be logical or physical addresses.

**USE** *file*

This directive causes TLDlnk to read directives from the specified file until it encounters an END directive. Upon encountering the END directive in the specified file, TLDlnk returns to the directive following the USE directive.

## APPENDIX C

### APPENDIX F OF THE Ada STANDARD

The only allowed implementation dependencies correspond to implementation-dependent pragmas, to certain machine-dependent conventions as mentioned in Chapter 13 of the Ada Standard, and to certain allowed restrictions on representation clauses. The implementation-dependent characteristics of this Ada implementation, as described in this Appendix, are provided by the customer. Unless specifically noted otherwise, references in this Appendix are to compiler documentation and not to this report. Implementation-specific portions of the package STANDARD, which are not a part of Appendix F, are:

package STANDARD is

.....

type INTEGER is range -32768 .. 32767;

type FLOAT is digits 6 range  $-1.0 \times 2.0^{127}$  ..  $0.999999 \times 2.0^{127}$ ;

type DURATION is delta  $2.0^{(-14)}$  range -86400.0 .. 86400.0;

type LONG\_INTEGER is range -2147483648 .. 2147483647;

type LONG\_FLOAT is digits 9  
range  $-1.0 \times 2.0^{127}$  ..  $0.999999999 \times 2.0^{127}$ ;

.....

end STANDARD;

## APPENDIX F OF THE Ada STANDARD

In the customer's Appendix F documentation that constitutes this appendix, some information appears to be inaccurate or incomplete; the AVF offered the customer an opportunity to redress these points, but the customer declined to do so.

The customer declined to provide the AVF with an updated list of all compiler/linker options and the options used specifically for this validation.

On page C-7, the customer states that the subtype priority is integer range 1 .. 16#3EFF#. However the correct range is 1 .. 64.

On page C-8, the customer states that address clauses for task entries (interrupts) are not supported. However, test B91001H contains such an address clause, and this test was passed. Also, in a petition against this test for a Data General implementation, which does not support such address clauses, the customer asserts that all of the 1750A implementations do support them.

On page C-10, the customer states that the range of priority is 0 to 16366. The correct range is 1 to 64.

On page C-11, the customer states that access objects are implemented as 16-bit integers. However, for tests CD2A81A et al. (See section 2.3), the AVF was requested to increase by 32 bits the size used for access objects whose designated objects are strings.

On page C-12, the customer states that the pragma priority is supported with values of 1 to 16366. The correct range is 1 to 64.

The Ada language definition allows for certain machine dependencies in a controlled manner. No machine-dependent syntax of semantic extensions or restrictions are allowed. The only allowed implementation-dependencies correspond to implementation-dependent pragmas and attributes, certain machine-dependent conventions as mentioned in chapter 13 of the MIL-STD-1815A; and certain allowed restrictions on representation clauses.

The full definition of the implementation-dependent characteristics of the TLD Sun-4/MIL-STD-1750A Ada Compiler System is presented in this Appendix F.

#### Implementation-Dependent Pragmas

The TLD ACS supports the following implementation dependent pragmas.

Pragma Collect (type\_name, attribute);

This pragma tells the compiler to collect all objects of specified type\_name and subtypes of type\_name into unmapped control sections. An "unmapped control section" is allocated a physical memory location not covered by a page register. Unmapped control sections are accessed from a device by DMA or by IBM GVSC extended instructions.

Pragma Control\_Section (USECT, UNMAPPED, object\_name {, object\_name...} );

This pragma specifies data objects that will be put into unmapped control sections. The first two parameters must be USECT and UNMAPPED and the remaining parameters are the names of Ada objects. An "unmapped control section" is allocated a physical memory location not covered by a page register. Unmapped control sections are accessed from a device by DMA or by IBM GVSC extended instructions.

Pragma C.ntiguous (type\_name);  
Pragma Contiguous (object\_name);

This pragma is used as a query to determine whether the compiler has allocated the specified type of object in a contiguous block of memory words. The compiler will generate a warning message if the allocation is noncontiguous or is undetermined. The allocation probably will be noncontiguous when data structures have dynamically sized components. The allocation probably will be undetermined when unresolved private types are forward type declarations. This pragma provides information to the programmer about the allocation scheme used by the compiler.

## APPENDIX F OF THE Ada STANDARD

```
Pragma Export (Language_name, Ada_entity_name, {String});
```

This pragma is a complement to Pragma Interface and instructs the compiler to make the entity named available for reference by a foreign language module. The language name identifies the language in which the foreign module is coded. The only foreign language presently supported is Assembly. Ada and JOVIAL are permitted and presently mean the same as Assembly but the semantics of their use are subject to redefinition by future releases of the compiler. If the optional third parameter is present, the string provides the name by which the entity may be referenced by the foreign module. The contents of this string must conform to the conventions for the indicated foreign language and the linker being used. No check is made by the compiler to insure that these conventions are obeyed.

Only objects having static allocation and subprograms are supported by pragma Export. If the Ada entity named is a subprogram, this pragma must be placed within the declarative region of the named subprogram. If the name is that of an object, the pragma must be placed within the same declarative region and following the object declaration. It is the responsibility of the programmer to insure that the subprogram and object are elaborated before the reference is made.

```
pragma If (Compile Time Expression);  
pragma Elself (Compile_Time_Expression);  
pragma Else;  
pragma Endif;
```

These Source directives may be used to enclose conditionally compiled source to enhance program portability and configuration adaptation. These directives may occur at the place that language defined pragmas, statements, or declarations may occur. Source code following these pragmas will be compiled or ignored similar to the semantics of the corresponding Ada statements depending upon whether the Compile\_Time\_Expression is true or false, respectively. The primary difference between these pragmas and the corresponding Ada Statements are that the pragmas may enclose declarations and other pragmas.

```
Pragma Interrupt_Kind (Entry_Name, Entry_Type {, Duration } );
```

This pragma must appear in the task specification and must appear after the Entry Name is declared. Allowed Entry\_Type are Ordinary, Timed, and Conditional. The optional parameter Duration is applicable only to timed entries and is the time to wait for an accept.

For an Ordinary entry, if the accept is not ready, the task is queried.



For a Timed entry, if the accept is not ready, the program waits for the period of time specified by the Duration. If the accept does not become ready in that period, the interrupt is ignored.

For a Conditional entry, if the accept is not ready, the interrupt is ignored.

Pragma Load (literal\_string);

This pragma makes the compiler include a foreign object (identified by the literal\_string) into the link command.

Pragma Monitor;

Pragma Monitor can eliminate tasking context overhead. The pragma identifies Ada tasks that obey certain restrictions (listed below), allowing efficient invocation by the compiler. With Pragma Monitor, a simple procedure call is used to invoke task entry.

The pragma only applies to tasks that have the following restrictions:

- o Monitor tasks must only be declared in library level non-generic packages
- o Monitor tasks may contain data declarations only within the accept statement.
- o A monitor task consists of an infinite loop containing one select statement.
- o The "when condition" is not allowed in the select alternative of the select statement.
- o The only selective wait alternative allowed in the select statement is the accept alternative.
- o All executable statements of a monitor task must occur within an accept statement.
- o Only one accept statement is allowed for each entry declared in the task specification.

If a task body violates restrictions placed on monitor tasks, it is identified as erroneous and the compilation fails.

Pragma No\_Default\_Initialization;

Pragma No\_Default\_Initialization (typename, {, typename ...} );

## APPENDIX F OF THE Ada STANDARD

The LRM requires initialization of certain data structures even though no explicit initialization is coded. For example, the LRM requires access\_type objects to have an initial value of "NULL." The No\_Default\_Initialization pragma would prevent this default initialization.

In addition, initialization declared in a type statement is suppressed by this pragma.

The TLD implementation of packed records or records with representation clauses includes default initialization of filler bits, i.e., bits within the allocated size of a variant that are not associated with a record component for the variant. No\_Default\_Initialization prevents this default initialization.

No Default Initialization must be placed in the declaration region of the package, before any declaration that require elaboration code. The pragma remains in effect until the end of the compilation unit.

Pragma No\_Elaboration;

Pragma No\_Elaboration is used to prevent the generation of elaboration code for the containing scope. The pragma must be placed in the declaration region of the affected scope before any declaration that would otherwise produce elaboration code.

Pragma No\_Elaboration prevents otherwise unnecessary initialization of packages that are initialized by other non-Ada operations. Examples are ROM data and Read Time Kernel initialization. It is used to maintain the TLD Run Time Library (TLDrtdl) and is not intended for general use.

Pragma TCB\_Extension (value);

This Pragma is used to extend the size of the Task Control Block on the stack. It can be used only within a task specification. The parameter passed to this program must be static and represents the size to be extended in bytes.

Pragma Within\_Page (type\_name);  
Pragma Within\_Page (object\_name);

This pragma instructs the compiler to allocate the specified object, or each object of the specified type, as a contiguous block of memory words that does not span any page boundaries (a page is 4096 words).

The compiler will generate a warning message if the allocation is noncontiguous or not yet determined. Additionally, the compiler will generate a warning message if the pragma is in a nonstatic declarative region. If an object exceeds 4096 words, it will be allocated with an address at the beginning of a page, but it will span one or more succeeding

page boundaries and a warning message will be produced.

### Implementation-Dependent Attributes

#### Task\_Id

The Task\_Id attributes is used only with task objects. This TLD-defined attributes returns the actual system address of the task object.

### Specification of Package SYSTEM

#### Package SYSTEM

The following declarations are defined in package system:

```
type operating_system is ( unix, netos, vms, os_x, msdos, bare );
```

```
type name is (none, ns16000, vax, afl750, z8002, z8001, gould,
  pdp11, m68000, pe3200, caps, amdahl, i8086, i80286, i80386,
  z80000, ns32000, ibms1, m68020, nebula, name_x, hp);
```

```
system_name: constant name := name'target;
```

```
os_name:      constant operating_system := operating_system'system;
```

```
subtype priority is integer range 1..16#3EFF#; — 1 is default priority.
```

```
subtype interrupt_priority is integer range 16#3FF0#..16#3FFF#;
```

```
pragma put_line ('>', '>', '>', ' ', system_name,
  ' ', '/', ' ', os_name, ' ', '<', '<', '<');
```

```
type address is range 0 .. 65535;
for address'size use 16;
```

```
type unsigned is range 0 .. 65535;
for unsigned'size use 16;
```

```
type long_address is range 0..16#007FFFFFFF#; — 23 bit physical address
— for GVSC
```

#### — Language Defined Constants

```
storage_unit: constant := 16;
memory_size:  constant := 65536;
min_int:      constant := -2**31;
max_int:      constant := 2**31-1;
max_digits:   constant := 9;
max_mantissa: constant := 31;
fine_delta:   constant := 2.0*(-31);
tick:         constant := 1.0/10 000.0; — Clock ticks = 100 msecs.
rtc_tps:      constant := 10 000;
min_delay:    constant := rtc_tps * tick; — Minimum value of ADA delay
```

## APPENDIX F OF THE Ada STANDARD

address\_0:        constant address := 0;        — Zero address

### Restrictions on Representation Clauses

Enumeration representation clauses are supported for value ranges of Integer'First to Integer'Last.

Record representation clauses are supported to arrange record components within a record. Record components may not be specified to cross a word boundary unless they are arranged to encompass two or more whole words. A record component of type record that has itself been "rep specificationed" may only be allocated at bit 0. Bits are numbered from left to right with bit 0 indicating the sign bit.

The alignment clause is not supported.

Address clauses are supported for variable objects and designate the virtual address of the object. The TLD Ada Compiler System treats the address specification as a means to access objects allocated by other than Ada means and accordingly does not treat the clause as a request to allocate the object at the indicated address.

Address clauses are not supported for constant objects, packages, tasks, or task entries.

### Implementation-Dependent Names

The TLD Ada Compiler System defines no implementation dependent names for compiler generated components.

### Interpretations of Expressions in Address Clauses

Address expression values and type Address represent a location in logical memory (in the program's current address state). For objects, the address specifies a location within the 64K word logical operand space. The 'Address attribute applied to a subprogram represents a 16 bit word address within the logical instruction space.

### Restrictions on Unchecked Conversion

Conversion of dynamically sized objects are not allowed.

### I/O Package Characteristics

The following implementation-defined types are declared in Text\_Io.

subtype Count is integer range 0 .. 511;

subtype Field is Integer range 0 .. 127;

#### Package Standard

The implementation-defined types of package Standard are:

```

type Integer is      range -32_768 .. 32_767;
type Long_Integer is range -2_147_483_648 .. 2_147_483_647;
type Float is digits 6 range -1.0*2.0**127 .. 0.999999*2.0**127;
type Long_Float is digits 9 range -1.0*2.0**127 .. 0.999999999*2.0**127;
type Duration is delta 2.0**(-14) range -86_400.0 .. 86_400.0;

```

#### Other System Dependencies

##### LRM Chapter 1.

None.

##### LRM Chapter 2.

Maximum source line length — 120 characters.

Source line terminator — Determined by the Editor used.

Maximum name length — 120 characters.

External representation of name characters.

Maximum String literal — 120 characters.

##### LRM Chapter 3.

LRM defined pragmas are recognized and processed as follows:

Controlled — Has no effect.

Elaborate — As described in the LRM.

Inline — Not presently supported.

Interface — Supported as a means of importing foreign language components into the Ada Program Library. May be applied either to a subprogram declaration as being specially implemented, — read Interface as Import —, or to an object that has been declared elsewhere. Interface languages supported are System for producing a call obeying the standard calling conventions except that the BEX instruction is used to cause a software interrupt into the kernel

## APPENDIX F OF THE Ada STANDARD

supervisor mode; Assembly for calling assembly language routines; and Mil-Std-1750A for defining built in instruction procedures. An optional third parameter is used to define a name other than the name of the Ada subprogram for interfacing with the linker.

List -- As defined in the LRM.

Memory Size -- Has no effect.

Optimize -- Has no effect. Optimization controlled by compiler command option.

Pack -- Has no effect.

Page -- As defined in the LRM.

Priority -- As defined in the LRM. Priority may range from 0 to 16366. Default priority is 1.

Shared -- As defined in the LRM. May be applied to scalar objects only.

Storage Unit -- Has no effect.

Suppress -- As defined in the LRM for suppressing checks; all standard checks may be suppressed individually as well as "Exception Info" and "All Checks". Suppression of Exception Info eliminates data used to provide symbolic debug information in the event of an unhandled exception. The All Checks selection eliminates all checks with a single pragma. In addition to the pragma, the compiler permits control of check suppression by command line option without the necessity of source changes.

System Name -- Has no effect.

Number declarations are not assigned addresses and their names are not permitted as a prefix to the 'address attribute. (Clarification only).

Objects are allocated by the compiler to occupy one or more 16 bit 1750A words. Only in the presence record representation clauses are objects allocated to less than a word.

Except for access objects, uninitialized objects contain an undefined value. An attempt to reference the value of an uninitialized object is not detected.

The maximum number of enumeration literals of all types is limited only by available symbol table space.

The predefined integer types are:

Integer range -32\_768 .. 32\_767 and is implemented as a 1750A single

precision fixed point data.  
 Long Integer range -2\_147\_483\_648 .. 2\_147\_483\_647 and implemented  
 as 1750A double precision data.  
 Short Integer is not supported.  
 System.Min\_Int is -2\_147\_483\_648.  
 System.Max\_Int is 2\_147\_483\_647.

The predefined real types are:

Float digits 6.  
 Long Float digits 15.  
 Short Float is not presently supported.  
 System.Max\_Digits is presently 9 and is implemented as 1750A 48-bit  
 floating point data.

Fixed point is implemented as 1750A single and double precision data as is  
 appropriate for the range and delta.

On the 1750A, index constraints as well as other address values such as  
 access types are limited to an unsigned range of 0 .. 65\_536 or a signed  
 range of -32\_768 .. 32\_767.

The maximum array size is limited to the size of virtual memory -- 64K  
 words.

The maximum String length is the same as for other arrays.

Access objects are implemented as an unsigned 16 bit 1750A integer. The  
 access literal Null is implemented as one word of zero on the 1750A.

There is no limit on the number of dimensions of an array type. Array  
 types are passed as parameters opposite unconstrained formal parameters  
 using a 3 word dope vector illustrated below:

Word address of first element
Low bound value of first dimension
Upper bound value of first dimension

Additional dimension bounds follow immediately for arrays with more than  
 one dimension.

#### LRM Chapter 4.

Machine\_Overflows is True for the 1750A.

Pragma Controlled has no effect for the TLD VAX/1750A Compiler since  
 garbage collection is never performed.

## APPENDIX F OF THE Ada STANDARD

### LRM Chapter 5.

The maximum number of statements in an Ada source program is undefined and limited only by the Symbol Table space.

Case statements unless they are quite sparse, are allowed as indexed jump vectors and are, therefore, quite fast.

Loop statements with a for implementation scheme are implemented most efficiently on the 1750A if the range is in reverse and down to zero.

Data declared in block statements on the 1750A is elaborated as part of its containing scope.

### LRM Chapter 6.

Arrays, records and task types are passed on the 1750A by reference.

Pragma Inline is not presently supported for subprograms.

### LRM Chapter 7.

Package elaboration is performed dynamically permitting a warm restart without the necessity to reload the program.

### LRM Chapter 8.

### LRM Chapter 9.

Task objects are implemented as access types pointing to a Task Information Block (TIB).

Type Time in package Calendar is declared as a record containing two double precision integer values: the date in days and the real time clock.

Pragma Priority is supported with a value of 1 to 16366.

Pragma Shared is supported for scalar objects.

### LRM Chapter 10.

Multiple Ada Program Libraries are supported with each library containing an optional ancestor library. The predefined packages are contained in the TLD standard library, ADA.LIB.

### LRM Chapter 11.

Exceptions are implemented by the TLD Ada Compiler System to take advantage of the normal policy in embedded computer system design to reserve 50% of the duty cycle. By executing a small number of instructions in the prologue of a procedure or block containing an exception handler, a branch may be taken, at the occurrence of an exception, directly to a handler



rather than performing the time consuming code of unwinding procedure calls and stack frames. The philosophy taken is that an exception signals an exceptional condition, perhaps a serious one involving recovery or reconfiguration, and that quick response in this situation is more important and worth the small throughput tradeoff in a real time environment.

#### LRM Chapter 12.

A single generic instance is generated for a generic body. Generic specifications and bodies need not be compiled together nor need a body be compiled prior to the compilation of an instantiation. Because of the single expansion, this implementation of generics tend to be more favorable on the 1750A because of usual space savings achieved. To achieve this tradeoff, the instantiations must by nature be more general and are, therefore, somewhat less efficient timewise.

#### LRM Chapter 13.

Representation clause support and restrictions are defined above.

A comprehensive Machine\_Code package is provided and supported.

Unchecked\_Deallocation and Unchecked\_Conversion are supported.

The implementation dependent attributes are all supported except 'Storage\_Size for an access type.

#### LRM Chapter 14.

Full file I/O operations are not supported for the 1750A. Text\_Io and Low\_Level\_Io are supported.